

## A new genus of the subfamily Apaturinae (Nymphalidae)

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In this paper a new genus, *Protapatura*, is founded to receive the new species which is described by Mr. S. IGARASHI in the next paper. This new genus is remarkable not only in its systematic position but in its geographical distribution and habitat. The new genus superficially very much resembles the genus *Apatura* and its allies, but the structures of the male genitalia show some peculiar features, of which the basal structure of the saccus seems to be the most primitive in the Apaturinae, while the phallic and uncus structures are undoubtedly the results of unique specializations.

The Apaturinae is one of the nymphalid groups of which the main habitats are in the Sino-Malayan region under the humid temperate and subtropical climates. The new genus is distributed in the Northern Iraq and it seems to be a relic genus of the primitive apaturines surviving in the border of the distributional range of the subfamily under the arid climate. The systematic position of the new genus in the Apaturinae besides its geographical distribution is similar to that of the *Archon* in the Papilionidae.

Before going further we would like to express our cordial thanks to Mr. SUGURU IGARASHI, who have first found the type-species under difficult condition, for his kindness allowing us to study on this unique type-species.

*Protapatura* SHIRÔZU & SAIGUSA, gen. nov.

Type-species: *Protapatura iwasei* IGARASHI, 1971

**Generic characters.** Compound eye bare. Antenna slightly longer than half length of forewing in ♂, almost as long as or slightly shorter in ♀; club well marked, longish ovate and flattened in dried specimens. Labial palpus thick and short, without long hairs; 3rd segment conical, shorter than in most of apaturine genera (e. g. *Apatura*, *Hestina*, etc.). Proboscis yellowish in life. Legs compactly scaled, tibiae with two ventral rows of short spines. Forewing broadly triangular; costa slightly arched; apex weakly subacute, only weakly produced in ♂; termen slightly concave in ♂; almost straight in ♀, tornus broadly rounded; dorsum straight; discoidal cell open; upper discocellular only being present and very short, middle discocellular short and straight; veins 7, 8 and 9 stalked; vein 8 long, nearly  $2/5 \times$  as long as distance between apices of discoidal cell and wing; vein 9 out of vein 7 slightly proximad of basal  $2/5$  between apices of discoidal cell and wing; veins 10 and 11 free (the former rarely short stalked with vein 7), distance between origins of veins 10 and 7 (stem of veins 7, 8 and 9) almost as long as middle discocellular; vein 12 terminating slightly distad of origin of vein 9. Hindwing ovate; costa slightly arched; apex blunt; termen scalloped, evenly rounded; tornus angular, but not well marked; dorsum arched; discoidal cell open, veins 5, 6 and 7 approximate at base. Wing markings similar to those of *Apatura*, but yellowish discal markings in a broad band, and pale area between postdiscal and submarginal dark bands of forewing (of le Moul, 1950) appearing as a large preapical spot.

**Male genitalia:** Dorsum small comparing with vinculum; tegumen short, completely united with uncus, its dorsomedian portion weakly desclerotized; appendix angularis small but well developed, articulated with basal portion of costa of valva; uncus slightly longer than termen, very broad on basal half, abruptly tapered beyond the middle when viewed from above, and ending in a rather truncate apex; uncus with a pair of minute pits on basal portion near lateral margins, and with a pair of longitudinal subdorsal keels which run along the lateral submargin of uncus and give bifurcate appearance to tip of uncus; gnathos broad and rather drooping, loosely connected with border of uncus and tegumen, its ventromedian portion broadly desclerotized, and its dorsal (basal) portion raised along each side of uncus; vinculum deep, almost  $3 \times$  as high as tegumen, almost evenly slender, ventromedian portion of vinculum proper having a shallow longitudinal furrow continuing to the

dorsal wall of saccus, ventromedian portion of fold of vinculum with a slender longitudinal membranous incision from the intersegmental membrane; saccus well developed and slender, slightly longer than height of ring, with rounded tip; juxta being a U-shaped sclerite, close to the proximal margin

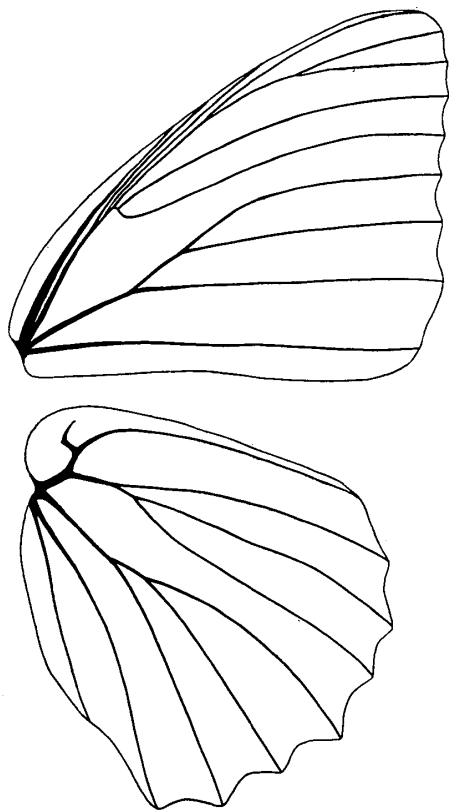


Fig. 1. Venation of *Protapatura iwasei* IGARASHI, ♀.

of sacculus of valva on its ventral margin; phallus much elongate and almost evenly slender, nearly  $2 \times$  as long as height of ring, zone situated at the middle, coecum penis well developed as in most apaturine species, bulbus ejaculatorius from dorsal wall of subzonal sheath, and opening anteriorly, cuticula exterior with a few minute spines; vesica opening dorsodistal portion of phallus, ventrolateral wall of vesica near opening sclerotized, perivesical area with a large sclerotized process, cornuti absent; diaphragma above manica forming a pocketlike pouch to receive the perivesical process of phallus; valva large and broad, articulated with appendix angularis, subventral portion of vinculum and ventral margin of juxta; costa+ampulla region narrow, sacculus with a serrate low keel, a membranous incision invading between sacculus and harpe, anellifer very broad, distal  $1/3$  of inner surface of valva sclerotized, apical margin of valva truncate with an apical and preapical dorsal groups of spines.

Female genitalia: Seventh abdominal sternum almost as long as 6th sternum, deeply and broadly excavate on its ventromedian portion of the hind margin, which bears many stiff setae; genital plate consisting of the median plate and lateral plates of the lamella postvaginalis; the median plate longitudinal, more or less broadened posteriorly, invading into the excavated portion of the 7th sternum and with ostium bursae being a long invaginated slit; the lateral plates almost quadrate, narrowly separated from the median plate; ductus bursae well sclerotized, rather long and very thick, strongly compressed laterally; bursa copulatrix consisting of short stout neck, globose main pouch and an

elongate accessory pouch; the main pouch of bursa with a pair of semicircular signa; ductus seminalis attaching on the short dorsal lobe at neck of bursa; 8th tergum almost as long as 7th tergum, and its anterolateral corners forming an obtuse apophysis anterioris; papilla analis semicircular, with a long apophysis posterioris nearly  $2 \times$  as long as the papilla.

**Included species:** Only the type-species distributed in the Northern Iraq.

**Systematic position of *Protapatura*:** It is undoubtedly clear that the new genus, *Protapatura*, has no close relationship to any subfamilies of the Nymphalidae other than the Apaturinae, judging from the structures of the male genitalia, wing venation and other morphological characters. In the male genitalia of the Limenitinae, the phallus does not always form the coecum penis at its proximal end, the valva is usually narrow and has the slender membranous anellifer which lies between the broad costa+ampulla and the sacculus+harpe regions, and the saccus is never much elongated. In the Charaxinae the male genitalia more or less resemble the apaturine in the basic plan, but the two subfamilies are definitely different from each other in the following three characters: the phallus does not form the coecum penis, the bulbus ejaculatorius much expands proximally so that it becomes higher towards proximal ends of phallus, and the juxta projects into a pair of well-developed invaginated processes (almost certainly the muscle attachments) on its ventral margin. The male genitalia of *Protapatura* have not these three structures. In the Marpesiinae the appendix angularis is completely atrophied and the juxta is much elongate and slender. Any gnathal elements of the genitalia are also completely absent in the subfamily.

The new genus is apparently related to the Apaturinae, though its systematic position is somewhat

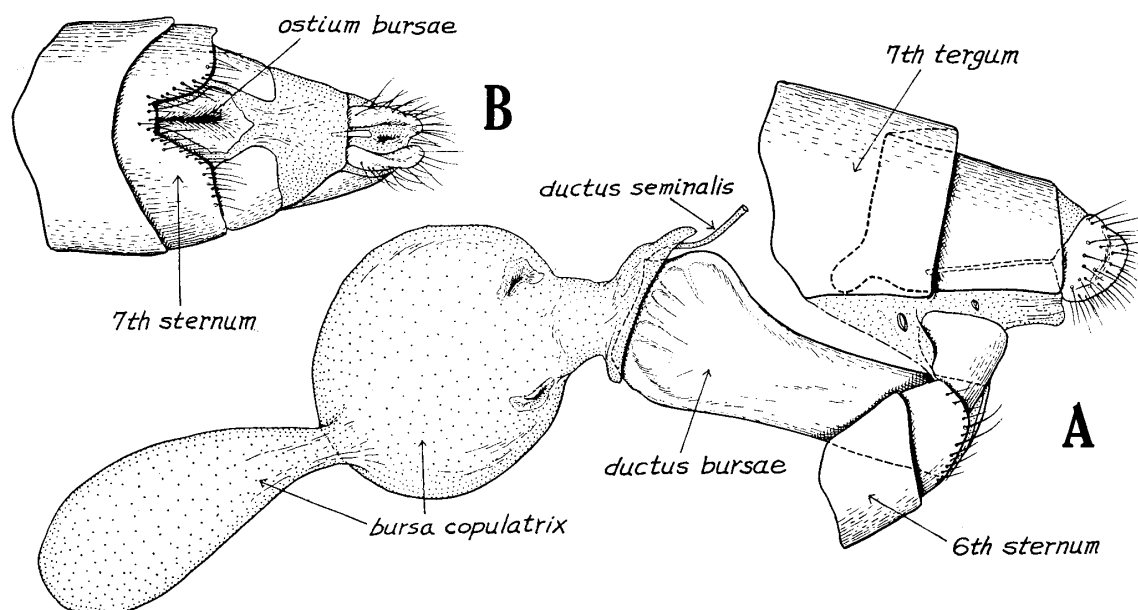


Fig. 2. ♀ genitalia of *Protapatura iwasei* IGARASHI. A: Lateral aspect. B: Ventral aspect.

isolated from the known genera of that subfamily. Among the subfamilies of Nymphalidae, the Apaturinae seems to be a rather well-defined monophyletic group characterized by the external structures of the adults. This view is also supported by its preimaginal stages; the larvae are slug-shaped with a pair of horns on the head after the second instar and a pair of posteriorly directing fleshy processes at the 10th abdominal segment, and the pupae are strongly compressed laterally and have the prominent abdominal dorsomedian ridge which is sometimes serrate at each intersegmental border; the larvae feed primarily on *Celtis* and its allies, and secondarily on *Salix*, *Quercus*, etc. in a few genera. Notwithstanding Mr. Igarashi's effort, the larvae of *Protapatura* is still undiscovered, then we are unable to determine its systematic position from the preimaginal stages.

The male genitalia are one of the important characters for the systematics of the Nymphalidae.

The general structures of the male genitalia of the Apaturinae are pointed out by SHIRŌZU (1960). The probable apomorphic characters of the apaturine male genitalia are as follows.

1. The proximal end of the phallus is developed into a coecum penis. In almost all the nymphalids the proximal end of the phallus is continuous to the membranous bulbus ejaculatorius which is either dorso-proximal, or proximal, or ventro-proximal (as in the genus *Agrias*), so that the coecum penis does not developed in these species. This structure is found only in the Apaturinae and a few other nymphalids (e. g. *Argyronome* and *Boloridi* of the Argynninae).

2. The phallus and the saccus of vinculum are slender and extraordinarily elongate, much longer than height of the ring. The phallus is frequently much elongated even in the Charaxinae, but in this case the saccus is shorter and enormously stout, its length is always less than a half length of the phallus.

3. The basal structure of the saccus of ring is specialized. In Lepidoptera the anterior marginal portion of the 9th sternum (vinculum) forms the fold which is continuous to the intersegmental membrane from the 8th abdominal sternum. The ventromedian portion of the folded line of the vinculum is sometimes invaginated into a tubular coecal process. This invaginated process is the saccus, and the invaginating pore is situated at the folded line. In the Apaturinae the dorsal margin of the pore gradually migrates posterodorsally into the ventromedian portion of the vinculum proper, thus the pore is represented by a short longitudinal ventromedian slit of vinculum, therefore the base of saccus is usually curiously curved.

Among these apomorphic characters, the first character is rarely attained in other nymphalids as stated above, and there is no subfamilies of which the most members have this structure. The second

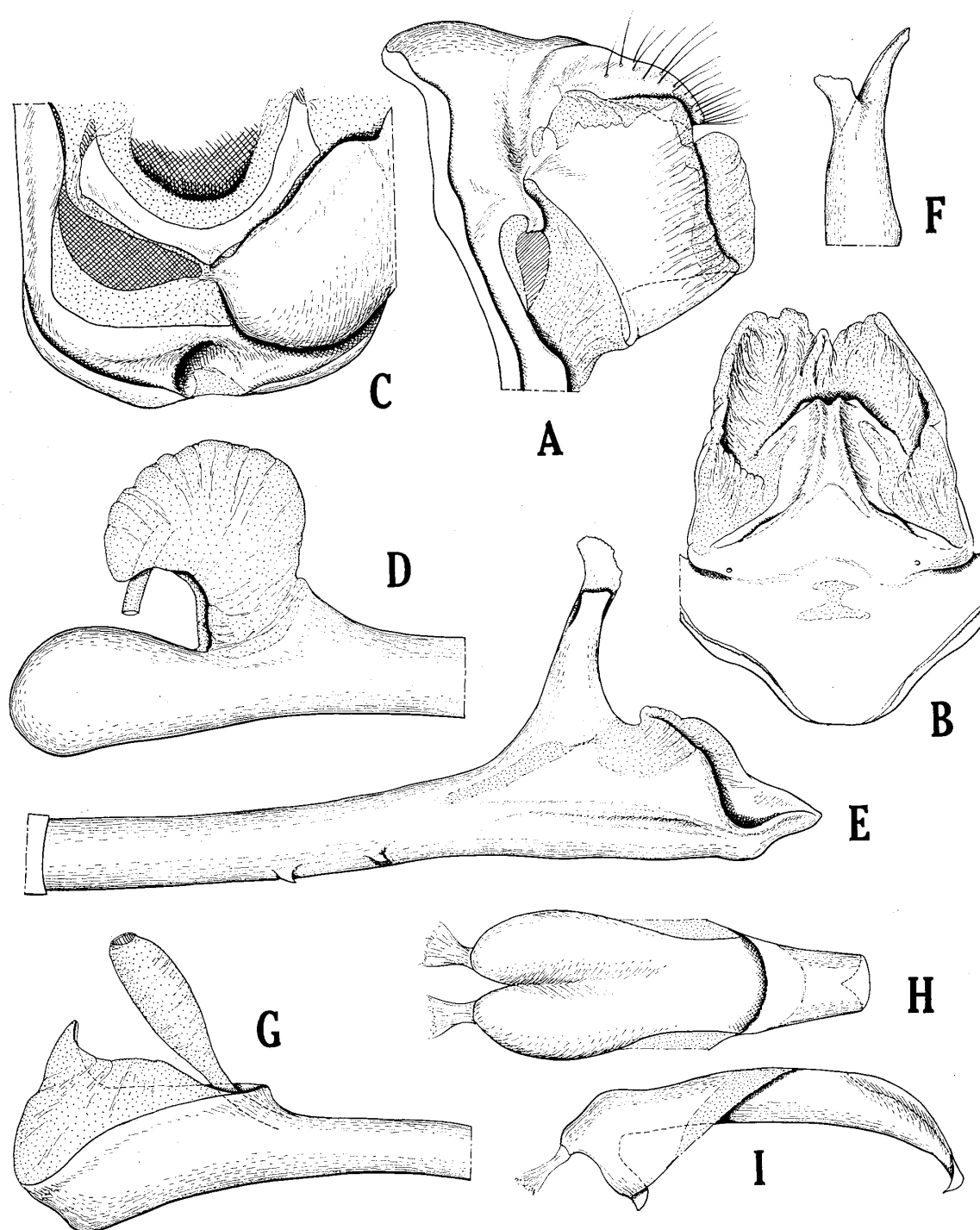


Fig. 3. A-F: ♂ genitalia of *Protapatura iwasei* IGARASHI (A: Lateral aspect of dorsum. B: Dorsal aspect of dorsum. C: Posterior aspect of ventral half of genitalia, right valva removed. D: Proximal portion of phallus. E: Distal portion of phallus. F: Posterior aspect of peri-vesical process of phallus). G: Proximal portion of phallus of *Charaxes castor*. H-I: Juxta of *Polyura narcaea meghaduta* FRUHSTORFER (H: Dorsal aspect. I: Lateral aspect).

character is rather relative. The elongation of phallus usually requires the corresponding specialization to the organs which support the phallus. In Charaxinae, the saccus is much thickened basally and the juxta is extraordinarily longitudinally lengthened and ventrally supports the phallus. In

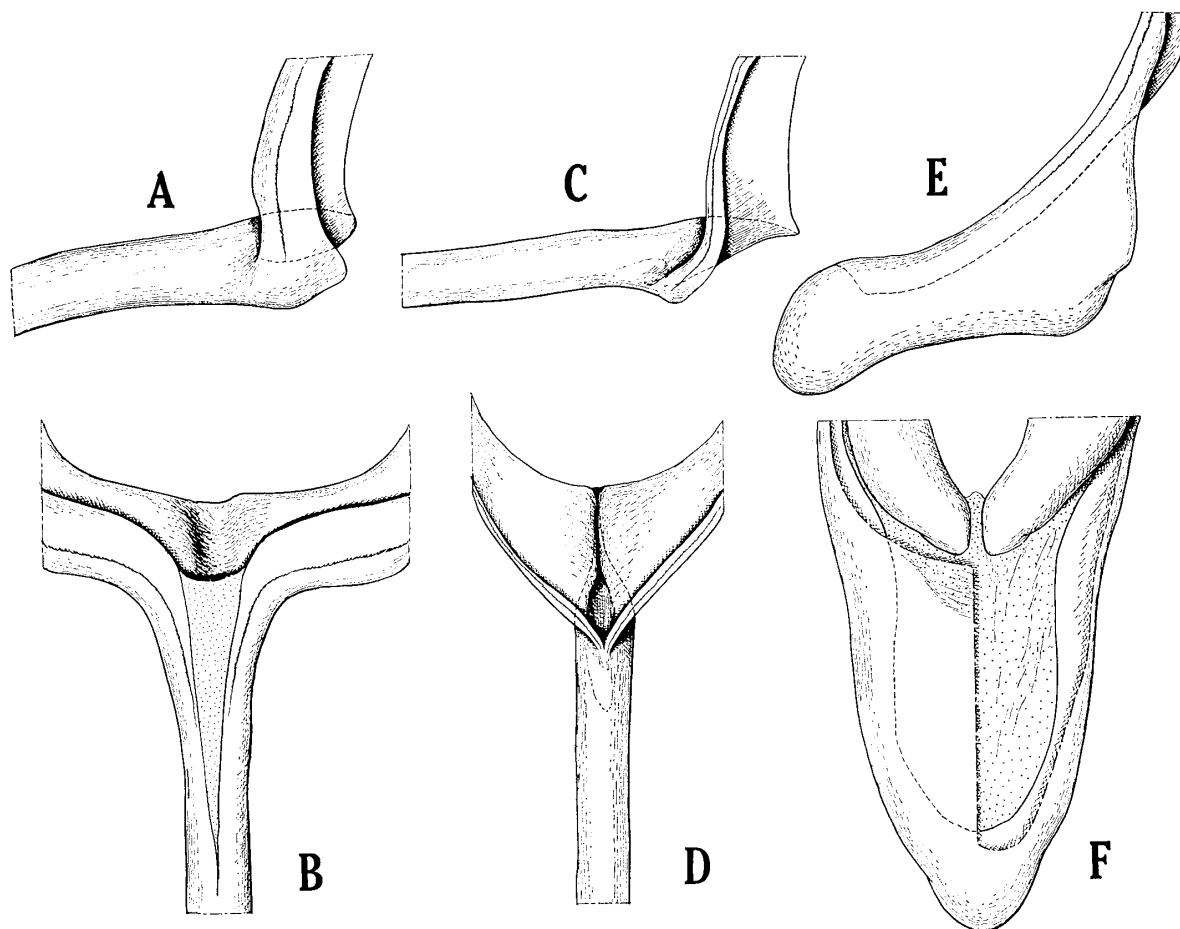


Fig. 4. Basal structures of saccus in Nymphalidae.

A, C, E: Lateral aspect. B, D, F: Ventral aspect. A, B: *Protapatura iwasei* IGARASHI.  
C, D: *Apatura ilia substituta* BUTLER (Apaturinae). E, F: *Polyura narcaea meghaduta*  
FRUHSTORFER.

the Marpesiinae and the genus *Kallima* of the Nymphalinae, the saccus is short but the juxta is much tapered, vertically lengthened and curved anterodorsally, in this case the phallus is more or less arched. In the Apaturinae the elongation of saccus without its thickening and the specilization of the saccal base seems to be only the adaptation to the elongation of the phallus. This type of correlation between the two organs seems to be mostly caused by the elongation of only the suprazonal sheath of the phallus. The similar elongation of the suprazonal sheath is exceptionally seen in some species of the Marpesiinae, and in these species the phallus is more or less arched and the juxta is elongated as usual of this subfamily. The third character is hitherto regarded as the most important apomorphic character to define the Apaturinae, and it is never found in any nymphalid species other than the apaturines. All the known apaturine genera including the peculiar *Timelaea* possess this character in the well-developed conditions.

The important pleisiomorphic characters of the apaturine male genitalia are as follows.

1. The juxta is normal, represented by a U-shaped lamella (short semicylindrical lamella) which is sometimes so much shortened that it becomes a crescent-shaped fine sclerite. It is never enormously developed as in the Charaxinae, and usually in a tendency of reduction.

2. The bulbus ejaculatorius opens anteriorly. In the Apaturinae it is developed on the dorsal surface of the subzonal sheath somewhat caudad of the coecum penis owing to the formation of coecum penis, and increases its height anteriorly.

In addition to these two characters, the gnathos is generally well developed, and the appendix

angularis is retained in normal size except for *Timelaea*, in which this organ is completely atrophied.

The followings are the comparison of the apaturine pleisiomorphic and apomorphic characters with the corresponding ones of *Protapatura*. Concerning with pleisiomorphy: In *Protapatura*, the juxta is U-shaped, without any special differentiations; the bulbus ejaculatorius is quite as in other apaturine genera; gnathos is broadly desclerotized at ventromedian portion, but its lateral portions are broadly sclerotized; the appendix angularis is moderately large as the apaturines and articulated with the proximal portion of costa of the valva. Thus *Protapatura* has all the important pleisiomorphic characters of the Apaturinae.

Concerning with the apomorphic characters *Protapatura* has two of the three apaturine characters stated above. The first and second characters are almost exclusively confined to the Apaturinae. Some argynnine genera having the coecum penis undoubtedly have no close kinship to *Protapatura*. Possession of the pleisiomorphic characters 1 and 2 indicates that *Protapatura* is most closely related to the Apaturinae. On the other hand, the basal structure of the saccus of *Protapatura* does not show the apaturine specialization, and retains rather generalized condition. But in *Protapatura*, a ventromedian longitudinal membranous slit invades from intersegmental membrane to the fold of vinculum and the ventromedian portion of vinculum proper forms the weak furrow which continuous to the dorsal wall of the saccus. This condition of the saccus seems to be intermediate between the generalized Lepidopterous and the specialized apaturine conditions.

The comparative morphology of the female genitalia of the Nymphalidae is very poorly investigated, and our knowledge concerning this organ is not enough to establish its pleisiomorphic condition. We have examined the female genitalia of the following apaturine genera: *Sasakia*, *Hestina*, *Hestinalis*, *Apatura*, *Chitoria*, *Bremeria*, *Sephisa*, *Dilipa*, *Timelaea* and *Helcyra*. So far as these genera are concerned, the female genitalia of the Apaturinae have the following characteristics. The ventral portion of the 6th to 8th segments lacks the prominent processes or invaginations other than a cup-like invagination of the genital plate towards the ostium bursae in a few genera. The 7th segment has a tendency to be shortened and tightly connected with the genital plate, and it always bears stiff setae on its hind margin. The genital plate is represented by a simple sclerite without a division of lamellae of ante- and postvaginalis, and ostium bursae opens near the anterior margin of the plate. The ductus bursae is sclerotized in varied degrees, and always much elongate corresponding with the length of the suprazonal sheath of the male phallus; the distal portion of ductus bursae is usually short telescoped into the bursa copulatrix. The ductus seminalis does not attach on the sclerotized ductus bursae, but always on the membranous lobe situated on the dorsal portion of neck of the bursa copulatrix. The bursa copulatrix is a single globose or semiglobose pouch, and a pair of signa frequently appear. The 8th abdominal tergum usually moderately long (considerably lengthened only in *Sephisa*), with or without short apophyses anteriores. The papilla analis is circular to semi-circular and equipped with an apophysis posterioris which is usually short and sometimes obsolete.

In the genus *Polyura* of the subfamily Charaxinae, the genital plate is apparently divided into the lamella antevaginalis and lamella postvaginalis, and the 7th abdominal sternum is not tightly connected with the lamella antevaginalis owing to the presence of a rather distinct intersegmental membrane between these two sclerites. Moreover, in this genus, a pair of large membranous invaginations are developed just below the papillae anales.

The female genitalia of the genus *Cyrestis* of the Marpesiinae are peculiar in a ornamentation of the genital plate. In this genus the 6th (not the 7th) abdominal sternum is extremely enlarged and the venters of the 7th and 8th segments are concealed as an invaginated cavity by the 6th sternum; the 7th and 8th sterna are represented by a composite sclerite expanded from the bottom to the dorsal wall of the cavity. The anterior portion of this sclerite (7th sternum or lodix in normal condition) bears a pair of lamellate lobes, and the ostium bursae opens at the middle of the dorsal wall of the cavity.

The female genitalia of the genus *Protapatura* apparently resemble those of the known apaturine genera we examined. The resemblance is seen in the close connection between the 7th sternum and the genital plate, and the presence of ostium bursae on the anterior portion of the simple genital plate. However, the following features are apparently the results of the specializations; the accessory lobe of the bursa copulatrix, the strongly compressed ductus ejaculatorius corresponding to the

development of the perivesical process of the male phallus. It is uncertain whether the trisected condition of the genital plate is pleisiomorphic or not in the subfamily Apaturinae. A similar, but not so prominently trisected, condition is also observed in the genus *Dichorragia* of the subfamily Pseudoergolinae. In this genus, however, the ductus seminalis attaches at near the middle of the short ductus bursae.

Judging from the male and female genitalia discussed above, wing venation, wing markings, head structures including the yellow proboscis and other morphological features, we consider that the genus *Protapatura* is a unique genus belonging to the subfamily Apaturinae.

The systematic position of *Protapatura* in the subfamily is undoubtedly much isolated. There is no genera which has more or less close relationship to this genus. If all the apaturine genera other than *Protapatura* are descendant derived from the common ancestor which was already attained the specialization of the base of saccus when it was differentiated into the process of evolution to the recent genera, it is highly probable that *Protapatura* was differentiated from the ancestral stock which retained the generalized condition of the saccal base. If this assumption is correct, then the recent Apaturinae may be consists of two monophyletic groups, one being *Protapatura*, and another containing all other apaturine genera including such specialized genera as *Eulaceura*.

Retaining such pleisiomorphic characters as saccal structure, *Protapatura* attains some strongly specialized features such as the accessory process on the perivesical area of the phallus and hood-like (not beak-like) uncus as are never seen in other apaturine genera. Even if the specialization of the saccal base in the different apaturine genera was attained not monophyletically but polyphyletically in several groups, of which each common ancestor retained the generalized saccus, it is not easy to presume that from which group the genus *Protapatura* is derived owing to the specialization of this genus.

## 緑岳におけるカラフトルリシジミの発見

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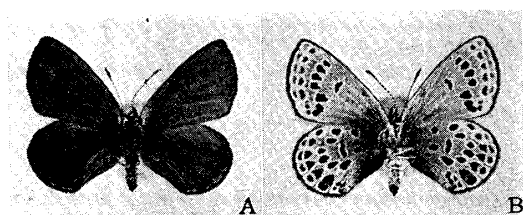


Fig. 1. *Vaciniina optilete daisetsuzana*  
MATSUMURA カラフトルリシジミ  
♀, 大雪山緑岳, 17. vii. 1970.  
(A. 表面; B. 裏面)

カラフトルリシジミ *Vaciniina optilete* KNOCH は表大雪山群では黒岳・桂月岳・凌雲岳・安足間岳・当麻岳・烏帽子岳・赤岳・雲ノ平・北海岳などから生息が知られているが、筆者は1970年7月17日に緑岳(松浦岳)中腹の標高1600 m地点で本種が多数発生しているのを観察した。当日は霧が濃く天候がすぐれなかったが、霧の晴れ間にはハイマツ上を多数がさかんに飛翔したり追尾したりしていた。恰度この頃が羽化最盛期で雌雄ともきわめて新鮮な個体ばかりであった。なお発生地は柴山尾根上部で残雪が全くなき一面ハイマツに蔽われ、その下に日本では大雪山系特産の低木で葉が細くそ

りかえったヒメイソツツジ *Ledum palustre* L. subsp. *decumbens* HULTÉN が群生しており、付近にはツツジ科 (Ericaceae) の植物は見当らず、おそらく幼虫はこれを摂食するものと思われる。筆者は確認のため2♂♂1♀を採集した。当地からは最初の記録と思われるので報告しておく。また知床半島の羅臼岳産のものに比較して裏面の地色は明るみの強い灰褐色である。

2♂♂1♀, 大雪山系緑岳, 17. vii. 1970, 多田豊採集保管。